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Methicillin - Resistant Staphylococcus Aureus (MRSA)

2003 - Louisiana Statewide
MRSA Advisory Committee

State of Louisiana
Resistant Staphylococcus Aureus Management Guidelines
Methicillin Resistant (MRSA)

Louisiana Statewide Antibiotic Sensitivity Advisory Committee

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1. INTRODUCTION

The purpose of these guidelines is to provide information to persons managing MRSA patients or MRSA outbreaks in institutions and the community in Louisiana and to establish uniformity of procedures for prevention, surveillance, diagnosis, patient transfer, infection control, and outbreak management.

Soon after introduction of penicillin to treat Staphylococcus aureus infections, resistance to penicillin started developing. In the 1950, the threat of penicillin resistant S.aureus was contained by the introduction of methicillin, an antibiotic active on penicillin resistant S.aureus. Although starting in the 1960s, methicillin resistant S.aureus (MRSA) did not become very prevalent until the 1980s.

1.1 Basic Facts About MRSA

1.1.1 *Staphylococcus aureus (S. aureus)*

Staphylococcus aureus is a gram-positive coccus that thrives on human skin and mucous membranes, grows rapidly under either aerobic or anaerobic conditions, and can be carried by its host for long periods of time without causing clinical consequences. However, if given the opportunity, *S. aureus* can be responsible for a variety of serious diseases, most notably suppurative skin infections, cellulitis, wound infections, abscesses, pneumonia and sepsis. The organism elaborates toxins, which cause such diverse manifestations as gastroenteritis and toxic shock syndrome. It is important to note the distinction between *S. aureus,* which is coagulase positive and the coagulase negative Staphylococcus, which includes *Staphylococcus epidermidis*, the most common organism found on the skin.

1.1.2 Penicillin and Methicillin

Originally all *S.aureus* were sensitive to penicillin but soon after penicillin was put in clinical use penicillin resistance developed. *S.aureus* had acquired the ability to inactivate the β-lactam ring of penicillin. Currently more than 95% of *S.aureus* are resistant to penicillin. Methicillin is a synthetic antibiotic related to penicillin with modified radicals designed to protect the penicillin ring against penicillinase. In the 1960's, *S.aureus* acquired methicillin resistance by changing the configuration of the penicillin binding protein. *S.aureus* resistant to oxacillin, methicillin and a few other related antibiotics are all known under the generic term methicillin resistant *S.aureus* or MRSA

1.1.3 MRSA Started in Hospitals and Other Medical Care Institutions: Hospital Associated MRSA or HA-MRSA

MRSA was initially reported in the 1960's and it quickly became known for its ability to cause large hospital outbreaks and become endemic. Since then, MRSA has become progressively more common. As a result, MRSA infections are often the source of a great deal of concern in institutions. Most strains of MRSA are sporadic but a few strains have the ability to spread very rapidly throughout an institution and reach epidemic levels. In 1999 the proportion of MRSA among S. aureus hospital associated infections in the USA was estimated at 50% with large local variations.

Because these organisms are resistant to many antibiotics, the infections are particularly difficult to treat. At the same time, employees and patients of institutions may become colonized with MRSA, and may serve as a source for infection for others. Outbreaks of MRSA infections in institutions are rare.

Institutions are taking measures to limit the introduction or spread of MRSA among their patients and staff. These measures have met with limited success. Some have led to problems in other institutions. There have been problems regarding transfer of MRSA-infected or -colonized patients between institutions. In addition, there is wide variation among institutions and medical providers in methods of treatment, infection-control policies, handling of colonized patient and staff, outbreak control, and prevention. In some instances, MRSA is not viewed seriously enough, and

outbreaks occur without appropriate response. In other situations, MRSA is viewed with such fear that costly and unnecessary precautions are undertaken.

Many HA-MRSA strains tend to be colonizers, which are present on the skin or mucosa and cause no infection, no disease. Others have the same pathogenic potential as regular S. aureus. No difference is found in animal lethality, in production of extracellular enzymes or toxins, in intraleukocyte survival.

1.1.4 MRSA as a Community Associated Organism (CA-MRSA)

MRSA has spread in the community and now is also be a community-associated organism. These community-associated strains have been isolated from people without risk factors (Redbook 2003). Community associated MRSA infections are commonly reported in miscellaneous groups: patients with cystic fibrosis, day-care centers, wrestling teams, and prisons (Estrada, 2001).

- CA-MRSA infections appear to be an emerging phenomenon worldwide. The genetic background of CA-MRSA organisms was different in three continents. The suggestion is that dissemination of a single CA-MRSA clone did not occur around the world but rather suggests the possibility of simultaneous co-evolution of CA-MRSA organisms in different locations (Vandenesch 2003).

- Unique clones of MRSA are increasingly responsible for community-acquired infections.

- The antimicrobial patterns of these strains are unique and differ from HA-MRSA, because they are resistant to methicillin but are not multi-drug resistance. Many are sensitive to trimethoprim-sulfamethoxazole, clindamycin, aminoglycosides and quinolones). European isolates appeared more resistant (i.e., to kanamycin, tetracycline, and fusidic acid) than U.S. and Oceanian isolates (Vandenesch, 2003).

- The actual prevalence of CA-MRSA cannot be accurately determined but it is estimated that 40% of adult cases may be associated with acquisition outside the hospital (Chambers, 2001). The prevalence of CA-MRSA infection was estimated at 208/100,000 in Chicago (Hussain, 2000). The prevalence seems to have increased from 10/100,000 in 1988-90 to 259/100,000 in 1993-95.

- **CA-MRSA strains may be more virulent than HA-MRSA**: In 1999, CDC reported 4 cases of lethal MRSA infections among children (12 months to 13 years from Minnesota and N. Dakota) who clearly had community associated infections (hepatic abscess, brain abscess and necrotizing pneumonia) (Stratton, 2001). Unlike HA-MRSA strains, CA-MRSA stains produce superantigens (SEB and SEC, but not TSST-1). Superantigen production is a recently described virulence factor of both staphylococci and streptococci and is important because superantigen production by these microbes in immunologically naïve persons can cause toxic shock syndrome.

Only two genes were unique to CA-MRSA isolates and shared by isolates from three continents: a type IV SCC*mec* cassette and the PVL locus (Panton-Valentine leukocidin - the PVL locus that is carried on a bacteriophage. PVL represents a stable genetic marker of these CA-MRSA strains, which explains the frequency of primary skin infections and occasionally necrotizing pneumonia associated with these strains. PVL and SCC*mec* type IV may confer a selective advantage for community-based MRSA pathogens.

- Multi Locus Sequence Typing (MLST) and PFGE (Pulse Field Gel Electrophoresis) analysis showed that within a continent, the genetic background of CA-MRSA strains did not correspond to that of HA-MRSA in the same continent, suggesting that CA-MRSA did not emerge from local HA-MRSA.

In light of these findings it appears that attempting to reduce CA-MRSA by strict infection control is a futile exercise. Control of MRSA in hospital and other health care facility is, of course, a very useful measure that certainly will limit the number of HA-MRSA but is not expected to have a significant impact on CA-MRSA.

1.1. 5 Epidemiology of MRSA

S. aureus is a common colonizer of skin and mucous membranes. Colonization may be transient (few weeks) or last for long periods of time (months). Some patients are more often colonized than others: newborns, diabetics, patients with skin diseases (eczema), and hemodialysis patients.

The **sites of colonization** are:
ŸNasal area
Ÿperineum, anal area
Ÿaxillary areas, finger tips
Ÿtracheostomy sites, wounds, sputum from intubated patient

Staphylococci are transmitted by direct skin-to-skin contact. The source of infection may be an infected or a colonized individual. Usually the organism spreads from hands of the infected/colonized individual to the skin of another individual. In general, transmission of staphylococci does not occur by droplet, airborne or indirect contact with contaminated objects (fomites).

In Louisiana, it is estimated that about 5-20% of S. aureus in the community are MRSA. This means that out of a 4,500,000 population, 1,500,000 are carriers of S. aureus and 75,000 to 300,000 are carriers of MRSA.

2. MANAGEMENT OF MRSA IN INSTITUTIONS

Institutions are at particular risk of having population with high antimicrobial resistance. The factors that may increase antimicrobial resistance in hospitals are (McGowan, 1994):

- Greater severity of illness of hospitalized patients
- More severely immunocompromised patients
- Newer devices and procedures in use
- Increased introduction of resistant organisms from the community
- Ineffective infection control and isolation practices and compliance
- Increased use of antimicrobial prophylaxis
- Increased empiric polymicrobial antimicrobial therapy
- High antimicrobial usage per geographic area per unit time

2.1 Hospital Admission

MRSA colonization does not warrant hospital admission. Treatment of a MRSA infection may be accomplished as an outpatient, in a home/extended care facility or in an acute care setting. This decision should be made based on the clinical judgment of the attending physician, possibly with the input of an infectious disease consultant.

2.2 Nursing Home/Extended Care Facility

A patient with clinical MRSA infection **can be admitted or treated in a nursing home/extended care facility based on clinical judgment**. Hospitals can transfer patients with active infection to nursing homes/extended-care facilities if the clinical manifestations of infection show signs of improvement and if the nursing home/extended-care facility is equipped to manage the wound and necessary antibiotic therapy. Denial of admission to a nursing home/extended-care facility should be based on medical eligibility, **not on culture results**.

A patient infected or colonized by MRSA while hospitalized should be discharged once the accompanying medical condition is under control. Thus, a patient colonized with MRSA may be discharged from an acute-care setting to a nursing home/extended-care facility or to home with a positive MRSA culture. Facilities **may not refuse admission** to such patients.

If a patient known to be colonized or infected by MRSA and is transferred to another health care facility, the receiving facility must be notified that the patient is colonized or infected with MRSA. **Written** communication (e.g., on the

patient transfer form) that the patient is colonized or infected with MRSA **must** accompany the transferring paperwork to the receiving institution.

2.3 Discharge to Private Home

Patients colonized and/or infected with MRSA may be transferred home if families and/or home health care services are equipped to manage wound and antibiotic therapy. If the patient is to be discharged from an acute-care or nursing home/extended-care facility to a private home, there will be a need to educate the family that there is a difference in risk between MRSA infection in the setting of a health care facility versus the home setting. The patient's family will invariably have noted the attention to infection control practices while their relative was hospitalized or in the nursing home/extended-care facility and will be concerned.

Reassure the family that MRSA colonization is common in healthy people.

2.4 Infection Control in Institutions

Isolation and precautions taken in institutions are aimed at preventing the transmission of MRSA from one patient to another, from a patient to a health care worker and from a health care worker to a patient. Given the prevalence of MRSA in both the populations in health care facilities and in the community and the impracticality of screening everyone for MRSA, prevention of transmission has to rely on the principle of universal precautions. Everyone should be handled as if they could be infected or colonized with MRSA.

The measures to prevent transmission of MRSA are
1-**Standard precautions'** (CDC 1996) supplemented with
2-**Contact precautions** should be used with patients known to be infected or colonized with MRSA.

In the following section CDC recommendations are presented with the strength of the recommendation categorized as IA, IB, IC, and II. The meaning of these categories is the following:

Categories
As in previous CDC/HICPAC guidelines, each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and economic impact. The CDC/HICPAC system for categorizing recommendations is as follows:
Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.
Category IB. Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiologic studies and a strong theoretical rationale.
Category IC. Required for implementation, as mandated by federal or state regulation or standard.
Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.
No recommendation. Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exist.

2.4.1 Standard Precautions and Contact Precautions

From CDC's Hospital Infection Control Practices Advisory Committee Recommendations for Isolation Precautions in Hospitals available at **http://www.cdc.gov/ncidod/hip/ISOLAT/isopart2.htm**

There are two tiers of HICPAC isolation precautions. In the first, and most important, tier are those precautions

designed for the care of all patients in hospitals, regardless of their diagnosis or presumed infection status. Implementation of these "Standard Precautions" is the primary strategy for successful nosocomial infection control. In the second tier are precautions designed only for the care of specified patients. These additional "Transmission-Based Precautions" are for patients known or suspected to be infected by epidemiologically important pathogens spread by airborne or droplet transmission or by contact with dry skin or contaminated surfaces.

2.4.1.1 Standard Precautions

Standard Precautions synthesize the major features of Universal Precautions (UP or Blood and Body Fluid Precautions) (designed to reduce the risk of transmission of bloodborne pathogens) and Body Substance Isolation (BSI), designed to reduce the risk of transmission of pathogens from moist body substances) and applies them to all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status. Standard Precautions apply to 1) blood; 2) all body fluids, secretions, and excretions except sweat, regardless of whether or not they contain visible blood; 3) non-intact skin; and 4) mucous membranes. Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals.

Use Standard Precautions, or the equivalent, for the care of all patients. Category IB

A. Handwashing

(1) Wash hands after touching blood, body fluids, secretions, excretions, and contaminated items, whether or not gloves are worn. Wash hands immediately after gloves are removed, between patient contacts, and when otherwise indicated to avoid transfer of microorganisms to other patients or environments. It may be necessary to wash hands between tasks and procedures on the same patient to prevent cross-contamination of different body sites. Category IB

(2) Use a plain (nonantimicrobial) soap for routine handwashing. Category IB

(3) Use an antimicrobial agent or a waterless antiseptic agent for specific circumstances (e.g., control of outbreaks or hyperendemic infections), as defined by the infection control program. Category IB (See Contact Precautions for additional recommendations on using antimicrobial and antiseptic agents.)

B. Gloves

Wear gloves (clean, nonsterile gloves are adequate) when touching blood, body fluids, secretions, excretions, and contaminated items. Put on clean gloves just before touching mucous membranes and nonintact skin. Change gloves between tasks and procedures on the same patient after contact with material that may contain a high concentration of microorganisms. Remove gloves promptly after use, before touching noncontaminated items and environmental surfaces, and before going to another patient, and wash hands immediately to avoid transfer of microorganisms to other patients or environments. Category IB

C. Mask, Eye Protection, Face Shield

Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, nose, and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions. Category IB

D. Gown

Wear a gown (a clean, nonsterile gown is adequate) to protect skin and to prevent soiling of clothing during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions. Select a gown that is appropriate for the activity and amount of fluid likely to be encountered. Remove a soiled gown as promptly as possible, and wash hands to avoid transfer of microorganisms to other patients or environments. Category IB

E. Patient-Care Equipment

Handle used patient-care equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to

other patients and environments. Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately. Ensure that single-use items are discarded properly. Category IB

F. Environmental Control
Ensure that the hospital has adequate procedures for the routine care, cleaning, and disinfection of environmental surfaces, beds, bedrails, bedside equipment, and other frequently touched surfaces, and ensure that these procedures are being followed. Category IB

G. Linen
Handle, transport, and process used linen soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures and contamination of clothing, and that avoids transfer of microorganisms to other patients and environments. Category IB

H. Occupational Health and Bloodborne Pathogens
(1) Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices; when handling sharp instruments after procedures; when cleaning used instruments; and when disposing of used needles. Never recap used needles, or otherwise manipulate them using both hands, or use any other technique that involves directing the point of a needle toward any part of the body; rather, use either a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath. Do not remove used needles from disposable syringes by hand, and do not bend, break, or otherwise manipulate used needles by hand. Place used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers, which are located as close as practical to the area in which the items were used, and place reusable syringes and needles in a puncture-resistant container for transport to the reprocessing area. Category IB

(2) Use mouthpieces, resuscitation bags, or other ventilation devices as an alternative to mouth-to-mouth resuscitation methods in areas where the need for resuscitation is predictable. Category IB

I. Patient Placement
Place a patient who contaminates the environment or who does not (or cannot be expected to) assist in maintaining appropriate hygiene or environmental control in a private room. If a private room is not available, consult with infection control professionals regarding patient placement or other alternatives. Category IB

2.4.1.2 Transmission-Based Precautions: Contact Precautions
Transmission-Based Precautions are designed for patients documented or suspected to be infected with highly transmissible or epidemiologically important pathogens for which additional precautions beyond Standard Precautions are needed to interrupt transmission in hospitals. There are three types of Transmission-Based Precautions: Airborne Precautions, Droplet Precautions, and Contact Precautions. They may be combined for diseases that have multiple routes of transmission. When used either singularly or in combination, they are to be used in addition to Standard Precautions.

Contact precautions are the most relevant for MRSA transmission and are discussed below.

***Contact Precautions** are designed to reduce the risk of transmission of epidemiologically important microorganisms by direct or indirect contact. Direct-contact transmission involves skin-to-skin contact and physical transfer of microorganisms to a susceptible host from an infected or colonized person, such as occurs when personnel turn patients, bathe patients, or perform other patient-care activities that require physical contact. Direct-contact transmission also can occur between two patients (e.g., by hand contact), with one serving as the source of infectious microorganisms and the other as a susceptible host. Indirect-contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, in the patient's environment. Contact Precautions apply to specified patients known or suspected to be infected or colonized (presence of microorganism in or on patient but without clinical signs and symptoms of infection) with epidemiologically important microorganisms than can be transmitted by direct or indirect contact.*

In addition to Standard Precautions, use Contact Precautions, or the equivalent, for specified patients known or suspected to be infected or colonized with epidemiologically important microorganisms that can be transmitted by direct contact with the patient (hand or skin-to-skin contact that occurs when performing patient-care activities that require touching the patient's dry skin) or indirect contact (touching) with environmental surfaces or patient-care items in the patient's environment. Category IB

A. Patient Placement
Place the patient in a private room. When a private room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection (cohorting). When a private room is not available and cohorting is not achievable, consider the epidemiology of the microorganism and the patient population when determining patient placement. Consultation with infection control professionals is advised before patient placement. Category IB

B. Gloves and Handwashing
In addition to wearing gloves as outlined under Standard Precautions, wear gloves (clean, nonsterile gloves are adequate) when entering the room. During the course of providing care for a patient, change gloves after having contact with infective material that may contain high concentrations of microorganisms (fecal material and wound drainage). Remove gloves before leaving the patient's room and wash hands immediately with an antimicrobial agent or a waterless antiseptic agent. After glove removal and handwashing, ensure that hands do not touch potentially contaminated environmental surfaces or items in the patient's room to avoid transfer of microorganisms to other patients or environments. Category IB

C. Gown
In addition to wearing a gown as outlined under Standard Precautions, wear a gown (a clean, nonsterile gown is adequate) when entering the room if you anticipate that your clothing will have substantial contact with the patient, environmental surfaces, or items in the patient's room, or if the patient is incontinent or has diarrhea, an ileostomy, a colostomy, or wound drainage not contained by a dressing. Remove the gown before leaving the patient's environment. After gown removal, ensure that clothing does not contact potentially contaminated environmental surfaces to avoid transfer of microorganisms to other patients or environments. Category IB

D. Patient Transport
Limit the movement and transport of the patient from the room to essential purposes only. If the patient is transported out of the room, ensure that precautions are maintained to minimize the risk of transmission of microorganisms to other patients and contamination of environmental surfaces or equipment. Category IB

E. Patient-Care Equipment
When possible, dedicate the use of noncritical patient-care equipment to a single patient (or cohort of patients infected or colonized with the pathogen requiring precautions) to avoid sharing between patients. If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use for another patient. Category IB

2.4.2 Hand Hygiene recommendations

Hand hygiene is an important part of standard and contact precautions, specific recommendations are presented below.

Discontinuation of contact precautions is acceptable after a single culture from the nares and the site of infection are negative

***CDC Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force available at* http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm**

These recommendations are designed to improve hand-hygiene practices of HCWs and to reduce transmission of pathogenic microorganisms to patients and personnel in health-care settings. This guideline and its recommendations are not intended for use in food processing or food-service establishments, and are not meant to replace guidance provided by FDA's Model Food Code.

1. Indications for handwashing and hand antisepsis

A. When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water (IA).

B. If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in all other clinical situations described in items 1C--J (IA) (74,93,166,169,283,294,312,398). Alternatively, wash hands with an antimicrobial soap and water in all clinical situations described in items 1C--J (IB).

C. Decontaminate hands before having direct contact with patients (IB).

D. Decontaminate hands before donning sterile gloves when inserting a central intravascular catheter (IB).

E. Decontaminate hands before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure (IB).

F. Decontaminate hands after contact with a patient's intact skin (e.g., when taking a pulse or blood pressure, and lifting a patient) (IB).

G. Decontaminate hands after contact with body fluids or excretions, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled (IA).

H. Decontaminate hands if moving from a contaminated-body site to a clean-body site during patient care (II).

I. Decontaminate hands after contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient (II).

J. Decontaminate hands after removing gloves (IB).

K. Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or with an antimicrobial soap and water (IB).

L. Antimicrobial-impregnated wipes (i.e., towelettes) may be considered as an alternative to washing hands with non-antimicrobial soap and water. Because they are not as effective as alcohol-based hand rubs or washing hands with an antimicrobial soap and water for reducing bacterial counts on the hands of HCWs, they are not a substitute for using an alcohol-based hand rub or antimicrobial soap (IB).

M. Wash hands with non-antimicrobial soap and water or with antimicrobial soap and water if exposure to Bacillus anthracis is suspected or proven. The physical action of washing and rinsing hands under such circumstances is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores (II).

N. No recommendation can be made regarding the routine use of nonalcohol-based hand rubs for hand hygiene in health-care settings. Unresolved issue.

2. Hand-hygiene technique

A. *When decontaminating hands with an alcohol-based hand rub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry (IB). Follow the manufacturer's recommendations regarding the volume of product to use.*

B. *When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet (IB). Avoid using hot water, because repeated exposure to hot water may increase the risk of dermatitis (IB).*

C. *Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water. When bar soap is used, soap racks that facilitate drainage and small bars of soap should be used (II).*

D. *Multiple-use cloth towels of the hanging or roll type are not recommended for use in health-care settings (II).*

3. Surgical hand antisepsis

A. *Remove rings, watches, and bracelets before beginning the surgical hand scrub (II).*

B. *Remove debris from underneath fingernails using a nail cleaner under running water (II).*

C. *Surgical hand antisepsis using either an antimicrobial soap or an alcohol-based hand rub with persistent activity is recommended before donning sterile gloves when performing surgical procedures (IB).*

D. *When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, usually 2--6 minutes. Long scrub times (e.g., 10 minutes) are not necessary (IB).*

E. *When using an alcohol-based surgical hand-scrub product with persistent activity, follow the manufacturer's instructions. Before applying the alcohol solution, prewash hands and forearms with a non-antimicrobial soap and dry hands and forearms completely. After application of the alcohol-based product as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves (IB).*

4. Selection of hand-hygiene agents

A. *Provide personnel with efficacious hand-hygiene products that have low irritancy potential, particularly when these products are used multiple times per shift (IB). This recommendation applies to products used for hand antisepsis before and after patient care in clinical areas and to products used for surgical hand antisepsis by surgical personnel.*

B. *To maximize acceptance of hand-hygiene products by HCWs, solicit input from these employees regarding the feel, fragrance, and skin tolerance of any products under consideration. The cost of hand-hygiene products should not be the primary factor influencing product selection (IB).*

C. *When selecting non-antimicrobial soaps, antimicrobial soaps, or alcohol-based hand rubs, solicit information from manufacturers regarding any known interactions between products used to clean hands, skin care products, and the types of gloves used in the institution (II).*

D. *Before making purchasing decisions, evaluate the dispenser systems of various product manufacturers or distributors to ensure that dispensers function adequately and deliver an appropriate volume of product (II).*

E. Do not add soap to a partially empty soap dispenser. This practice of "topping off" dispensers can lead to bacterial contamination of soap (IA).

5. Skin care

A. Provide HCWs with hand lotions or creams to minimize the occurrence of irritant contact dermatitis associated with hand antisepsis or handwashing (IA).

B. Solicit information from manufacturers regarding any effects that hand lotions, creams, or alcohol-based hand antiseptics may have on the persistent effects of antimicrobial soaps being used in the institution (IB).

6. Other Aspects of Hand Hygiene

A. Do not wear artificial fingernails or extenders when having direct contact with patients at high risk (e.g., those in intensive-care units or operating rooms) (IA).

B. Keep natural nails tips less than 1/4-inch long (II).

C. Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, and nonintact skin could occur (IC).

D. Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient, and do not wash gloves between uses with different patients (IB).

E. Change gloves during patient care if moving from a contaminated body site to a clean body site (II).

F. No recommendation can be made regarding wearing rings in health-care settings. Unresolved issue

2.5 Surveillance and Management of MRSA in Institutions

These recommendations apply during normal situations, not to evaluate and manage an outbreak situation. Outbreak management and treatment are presented in following sections.

2.5.1 Screening

Routine screening of patients is optional however it is not recommended for staff unless in an outbreak situation.

Routine screening misses a significant fraction of colonized individuals. Routine screening is usually followed by treatment for decolonization, which often fails and is difficult to verify. Screening of employees leads to treatment for decolonization and exclusion, thus disrupting services. This approach proves to cause chaos and have little preventive value. Relying on screening provides a very false sense of security. The only effective way to prevent transmission is the **scrupulous implementation of standard and contact precautions.**

2.5.2 Culturing Patients

- Cultures are recommended upon the appearance of clinical signs of tissue invasion including serosanguinous fluid (even in the absence of purulence), purulent drainage, and erythema at the site of a wound, fever, elevated WBC count, or other manifestation of infection.
- At the present time, the literature does not recommend culturing wounds without clinical signs of infection.
- Culturing any wound site in individuals with a previous history of MRSA infection or colonization upon admission or readmission to a hospital or nursing home should be considered if clinically indicated.
- Culturing should follow specific procedures for obtaining specimens that have been established by the bacteriology

laboratory to which the specimen(s) will be sent. Gloves should be worn when obtaining specimens. Hands should be washed before and after obtaining cultures.

2.5.3 Surveillance Data Collection and Analysis

Data Collection: Each acute and nursing home/extended-care facility who want to evaluate whether they have a high colonization rate with MRSA should maintain a surveillance line-listing of the names and other appropriate information of current and past residents/patients who are known to be colonized or infected with MRSA with classification as colonization, community associated infection and hospital associated infection.

Analysis: A surveillance line listing should be maintained and reviewed by the designated infection control person to monitor trends over time.

A method of analysis is to calculate the incidence rates of institution-associated infections per 1000 patients' days as follows:

$$\text{MRSA Incidence Rate} = \frac{\text{\# of active institution associated infections during the month}}{\text{\# of patient days for the month}} \times 1000$$

Use of Analysis: Based on the analysis of the data, an endemic or epidemic rate can then be determined. Case counts or rates should be reported to appropriate medical staff or committees. Large or sudden increases in the MRSA incidence rate should alert infection control and medical staff about breakdown of infection control procedures or an outbreak of MRSA.

Identification of an outbreak: An outbreak of MRSA is defined as three or more epidemiologically linked cases of MRSA occurring within a 30-day period, or a substantial increase in the number of MRSA cases from the baseline endemic rate, even if cases are not epidemiologically linked.

2.6 Other Preventive Measures Applicable to Institutions

2.6.1 Infected Health Care Worker

Health care workers are expected to be colonized or infected as any other individual from the community where CA-MRSA is becoming increasingly prevalent. Nowadays, it is not justified to assume that a health care worker with MRSA has been infected in their work place.

For health care workers with MRSA infection, restriction from patient care or food handling activities is only indicated for those employees who have active lesions that cannot be *reliably* contained by a dressing or other barrier method. No work restrictions are necessary for personnel who are colonized unless they have been epidemiologically implicated in S. aureus transmission within the facility.

2.6.2 Prevention of Antibiotic Resistance

It has been noted that some outbreaks of MRSA in nursing homes/extended-care facilities have followed indiscriminate use of some broad-spectrum oral antibiotics. Although the literature does not definitely prove this association, it is prudent to avoid using antibiotics on all patients unless absolutely necessary. When antibiotic therapy is needed and if the situation is appropriate, narrow-spectrum antibiotics should be selected rather than broad-spectrum antibiotics

2.6.3 Skin Breakdown

Since many MRSA infections are associated with decubiti ulcers, skin breakdowns in adults and tracheostomy and gastrostomy sites in children, attention must be paid to maintaining the skin integrity of all patients.

3. MANAGEMENT OF COMMUNITY ASSOCIATED MRSA

3.1 Discharge of MRSA Patient in the Community

A patient with MRSA infection may be treated as an outpatient and may live in the home environment.

3.2 Education

The family needs to be educated about MRSA, its transmission and management. The patient's family members/caretakers need to understand that extraordinary infection control measures, beyond good handwashing and careful handling of soiled dressings, are not necessary in the home. If there is a highly susceptible family member (e.g., child with cystic fibrosis or immunocompromised patient), more extensive precautions might be in order. Because of the lack of selective antibiotic pressure in the home setting, even if family members and/or caretakers become transiently colonized with MRSA, they will usually not remain permanently colonized.

3.3 Screening

There is no need to screen family members for the same reasons mentioned in the section on MRSA management in institutions.

3.4 Culture

- For minor infections that are not going to be treated with antibiotics, routine cultures are not recommended.
- For severe infections treated with antibiotics, culturing and performing antibiotic sensitivity test would allow optimizing antibiotic treatment.

4. TREATMENT

4.1 Treatment of Infection

MRSA should be considered an infecting organism (as opposed to a colonizing organism or a contaminant) if a positive culture was obtained from a site showing clear clinical signs of tissue inflammation, e.g., purulent drainage, erythema, induration , or growth is reported from a normally sterile site).

While serious MRSA infections, such as pneumonia or bacteremia, are ground for hospital admission, many less severe MRSA infections can be effectively treated in an extended-care facility such as a nursing home, or as an outpatient.

HA-MRSA is frequently resistant to many of the antibiotics available for treatment. Therefore culturing and testing antibiotic sensitivity is essential.

Minimizing the antibiotic pressure that favors the selection of resistant strains is essential in controlling the emergence of these strains in the hospital and the community, regardless of their origin (Chambers, 2001).

Therefore, the physician must exercise clinical judgment to decide whether antibiotic treatment is warranted in addition to local care. Many staphylococcal infections even recurrent furunculosis (American College of Physicians 1991) do not need antibiotic treatment.

MRSA treatment guidelines are available from different organizations. Since these vary from time to time, it is best to refer to these guidelines available in textbooks of infectious diseases, pocket handbooks and numerous websites.

4.2 Recommendations Regarding Decolonization (in the rare circumstances where decolonization is recommended)

Decolonization refers to treatment of colonized persons with antibiotics or other measures to eradicate the organism from the site of colonization (skin and mucous membranes).

4.2.1 Decolonization in Institutions

Current literature has not conclusively demonstrated that routine decolonization of a person colonized with MRSA is an effective method of infection control (Boyce 1991, Bradley 1991, Smith 1991). Treatment of the carrier state among hospital staff, appears to have no effect on the spread of MRSA. Additionally, numerous studies of the effectiveness of various antibiotic or antiseptic regimens have failed to provide adequate proof of the overall usefulness of decolonization. It has been suggested in the literature that "decolonization should not be employed in nursing home settings unless patient-to-patient contact can be minimized or eliminated, and even then, the ability of the current regimens to eliminate the carrier state in this population must be considered uncertain" (Smith, 1991).

However, there may be medical reasons for the need for elimination of colonizing MRSA:

- If an outbreak and if, upon appropriate laboratory and epidemiological analysis, it appears that a patient or staff member is epidemiologically linked with an outbreak of MRSA, decolonization may be considered.

- If patients who are colonized with MRSA are immunocompromised or are more likely to spread the organisms due to behavior (e.g., developmentally disabled or confused), decolonization could be considered. However, even in these patients, the current literature has not conclusively demonstrated that routine decolonization is effective.

- Decolonization may be used to prevent another recurrence of infection in a patient who has had repeated infections caused by the same strain. (**NOTE:** This does not pertain to those that are only colonized and have never developed infection).

4.2.2 Decolonization Regimens (not routinely recommended):

Numerous antibiotics either used alone or in combination have been used to manage the carrier state with generally poor or inconsistent results. Antiseptics (chlorhexidine, hexachlorophene, povidone-iodine) have been used in handwashing, bathing, and shampooing to remove resident MRSA. Currently, there is little or no consensus as to the most effective way to eradicate colonizing MRSA. Specific treatment regimens for decolonization (e.g., treatment of an epidemiologically associated index case) should be made on a case-by-case basis.

It must be understood that the use of antibiotics may prolong the carrier state. Treatment of colonization is not without complications. Failure to eradicate colonization may result in a broader pattern of resistance in the MRSA than was present prior to the attempt at decolonization. Indiscriminate use of agents to eradicate colonization potentially creates a strong selective pressure that could encourage the emergence of resistance.

4.2.3 Staff Member Colonized with MRSA

Routine decolonization of staff is not recommended. If MRSA is spread within institutions, it is generally by transfer of organisms from an infected patient to the hands of employees and then to another patient. These employees carry the organisms only transiently; they are not colonized. Because of this, decolonization is unlikely to impact nosocomial spread and must not replace well-established principles of infection control and hygiene.

4.2.4 Community Associated MRSA

There is no need to decolonize contacts of CA-MRSA (family members, day care students, prison inmates, sports team members, etc.).

4.2.4 Surgical Prophylaxis

"Antimicrobial prophylaxis can decrease the incidence of infection, particularly wound infection, after certain operations, but this benefit must be weighed against the risks of toxic and allergic reactions, emergence of resistant bacteria, drug interactions, superinfection and cost"(Nichols, 2001).

Refer to available guidelines such as:

- The Medical Letter • Vol. 43 (Issue W1116-1117B) October 29, 2001

Medical Letter consultants generally recommend antimicrobial prophylaxis only for procedures with high infection rates, those involving implantation of prosthetic material and those in which the consequences of infection are especially serious.

- Quality Standard for Antimicrobial Prophylaxis in Surgical Procedures Clinical Infectious Diseases 1994;18: 422-7

5. LABORATORY CONSIDERATIONS

5.1 Role of the Lab

Laboratories can be of great assistance in detection of MRSA, so many assume that all such infections are diagnosed using the microbiology laboratory. However, this may not always be the case. Specimens may not be collected for all suspected MRSA, and if a specimen is collected, an etiologic agent may not be identified. Furthermore, a positive laboratory report does not mean the patient has MRSA infection. Isolation of a pathogenic organism may merely represent colonization of the patient by the organism. To accurately interpret laboratory findings, clinical and historical data are needed to confirm the identification of MRSA. Therefore, laboratories can be of benefit in surveillance activities, but laboratory reports are not sufficient for the identification and confirmation of MRSA infection. A cooperative working relationship between the laboratory and infection control practitioner is essential to assess MRSA activity in any facility.

Culture and susceptibility testing methods for identification of Staphylococcus aureus should be performed as established by the National Committee of Clinical Laboratory Standards (NCCLS). Upon submission of isolates for MRSA identification, labeling the specimen "MRSA suspect" may expedite and bring attention to proper handling of specimens. In turn, the laboratory should provide reports that should be easy to read, available in one specific location, and reported in a timely manner.

Save organisms isolated from culture, if possible, according to the each individual institutional policy or practice. Each facility should establish their own policy or length of time that these isolates should be stored. Storing these isolates is useful in the event of an outbreak.

5.2 Active Surveillance

The Emerging Pathogens Active Sentinel Surveillance system has been maintained in hospitals that voluntarily participate in reporting monthly lab aggregate data and individual case reports of MRSA, Vancomycin Resistant Enterococci (VRE) and also Drug Resistant Streptococcus Pneumoniae (DRSP). The field epidemiologists have been identifying the primary laboratory contact person in each acute care facility within their assigned regions and are actively recruiting new hospital lab reporting sites to participate in this surveillance activity.

The system collects laboratory data on total number of isolates grown and number that were resistant

- In an effort to standardize denominator date, report one culture per patient, per hospitalization
- Each month, aggregate totals (minus duplicates on a single patient) for Staphylococcus aureus, Enterococcus and Streptococcus pneumoniae should be reported – this number includes resistant and susceptible isolates
- For the same time period, report the number of these isolates which are resistant (VRE, MRSA, and DRSP)

6. MANAGEMENT OF OUTBREAKS

- When an outbreak is recognized, **immediate reinforcement of infection control procedures** (e.g., handwashing, standard precautions) to all staff is necessary.
- **Call the Infectious Disease Epidemiology Section at 1-800-256-2748**

6.1 Institutional Outbreaks

Assessing the extent of the outbreak

First establish a case definition for infection and colonization. All patients in the unit or wing where the cases have occurred may need to be cultured for MRSA.

Personnel should be cultured only if symptomatic or epidemiologically linked to transmission. In those situations, cultures should include the nares and any skin lesion. Culture-positive staff should be assessed on a case-by-case basis using the Employee Health Guidelines of the institution.

Nares (nose)

Culturing to establish colonization is generally not indicated. In outbreak settings, in which search for carriers is worthwhile, a culture should be obtained using one sterile swab moistened with sterile saline. The swab should be gently swirled in each anterior nares (the opening of each nostril) for 2-3 seconds. The same swab can be used for both nares. The swab should be placed in a transport system and labeled prior to shipping to a qualified laboratory for identification and susceptibility testing. The laboratory should be instructed to screen the specimen for MRSA only.

Surface cultures of broken skin

Standard laboratory protocols should be followed to obtain specimens for culture.

Before a culture is obtained form broken skin (a decubitus ulcer, an open wound, a gastrostomy, or a tracheostomy site), the area should be wiped with a sterile gauze pad moistened with sterile saline. The site should then be swabbed with a sterile culture swab using a gently rolling motion. If the site is purulent, the culture should be obtained from the most heavily involved area. The anatomical site of the specimen(s) should be clearly indicated on the requisition slip.

6.2 Management of Patients and Staff

During an outbreak, all MRSA infected patients should be physically separated from MRSA-negative patients with no staff crossover between the two groups (cohorting). Strict cohorting may not be achievable, but efforts to minimize the number of persons caring for MRSA-positive patients/residents should always be a goal. Two consecutive negative cultures 24 hours apart obtained 48 hours after completion of antibiotics are grounds for release from cohort.

Decolonization of patients or staff is not routinely recommended. This has not proven to be an effective control measure, because recolonization occurs. However, if staff is found to be epidemiologically linked to the outbreak, decolonization may be considered (see Recommendations regarding decolonization).

Patient-care providers who are colonized or infected with MRSA should be educated about the particular importance of handwashing.

Providers who are only colonized or who have infections that can be covered may continue to work except in certain high-risk areas such as newborn nurseries or oncology wards as defined by facilities; providers with open infections that cannot be covered should be excluded from direct patient care until the infections are cleared.

In general, it is not necessary or recommended to treat colonized employees with antibiotics. It may be warranted in an outbreak situation to treat an employee who is epidemiologically linked to the outbreak. This should be done only if the

evidence implicating the employee as a transmitter is strong. Multiple specimens may be required in order to determine if the employee is a part of the outbreak or is only transiently colonized. An epidemiologically linked culture-positive employee should be counseled regarding infection control precautions and any deficiencies should be corrected first. Facilities that consider treating colonized employees should refer to the treatment section of these guidelines.

6.3 Epidemiologic Investigation

Careful surveillance for additional infection or colonization should be undertaken. Weekly patient assessments on previously infected MRSA patients in extended-care facilities may be warranted.

Epidemic analysis of the outbreak should be made, including collecting information on all MRSA-infected patients such as:

- patient's location in the institution (before and after cohorting);
- date of admission and recent previous admissions;
- names of caregivers who have had direct contact with the patient;
- body site of infection or colonization;
- age, sex, and race;
- diagnosis; and
- treatment given.

These factors should be evaluated for the group of MRSA-infected patients to look for common features which may lead to specific control strategies.

During an MRSA outbreak, there are no reasons a nursing home/extended-care facility or hospital should restrict the transfer of patients between facilities or be closed to new admission, provided there is room. Nursing homes/extended-care facilities may continue to discharge patients, provided the guidelines for admission/discharge are followed. However, restriction of admissions or discharges should occur if it is determined that the facility is not following the proper protocols in caring for the residents already in the facility.

6.4 Pulsed Field Gel Electrophoresis (PFGE) and Phage Typing

PFGE is one tool available to assist public health officials, infection control practitioners, laboratory personnel, physicians, etc. in their efforts to determine if seemly unrelated isolates of the same organism are indeed the same strain. This has implications in disease surveillance and outbreak investigations. The test is not useful for managing individual patients.

PFGE is a laboratory technique that divides bacterial DNA into fragments. These fragments are embedded into a gel. An electric current is applied to the gel, causing the fragments to move across the gel. This movement leaves a pattern of bands. These bands are compared to determine the relatedness of different organisms. Ideally, the pattern of the bands among the outbreak isolates will be the same while those not related to the outbreak will be different. However, all of the bands from the outbreak organism may not be the same, for various reasons; therefore, the following guidelines are used. Isolates with more than a six band difference are considered unrelated to the outbreak organism. Isolates with a four to six band difference are considered possibly related to the outbreak organism and those with two or three band difference are usually considered subtypes of the outbreak organism.

PFGE does have some limitations-most notably time. It takes on the average 2-4 days to prepare organisms for testing. Also, it cannot always distinguish between all strains of an organism. Other typing methods may need to be used in conjunction with PFGE.

Because of the cost of this test, its use will be limited to situations such as nosocomial outbreaks, in which results will clearly assist in prevention and control measures.

Check with the Department of Health and Hospitals, Office of Public Health, Epidemiology Section for further assistance

at (504) 568-5005 (ask for your surveillance epidemiologist).

In general, phage typing has been replaced by PFGE to evaluate MRSA isolates from an outbreak.

6.5 Community Outbreaks

Community outbreaks have been reported among prison inmates, players of contact sports, family members, schools and day care centers. Most of the infections were benign skin or soft tissue infections. However, there were rare severe infections. Outbreaks occurring in a small group do not need to be investigated. Outbreaks involving large numbers of people are often investigated, but the investigations usually do not provide much information useful for prevention. Most outbreaks are not the result of a single source but result from transmission from person to person. Report an outbreak to Infectious Disease Epidemiology Section and discuss with a Surveillance Epidemiologist the need for an investigation.

The recommendations are:

- Evaluate with appropriate cultures severe infections and treatment failures of presumed S.aureus infections.
- Treat infections based on infecting organism's antibiograms
- Educate and recommend good personal hygiene: handwashing (particularly after touching infected lesions) and daily showers
- Personal providing care should follow standard precautions.

Use of PFGE is not routinely recommended in community associated outbreak investigation. Several investigators used PFGE in research projects on CA-MRSA to characterize the genotypes of isolates of CA-MRSA and compared these with the genotypes of HA-MRSA. They found the genotypes of CA-MRSA isolates to be closely related to each other, yet distinguishable from HA-MRSA isolates. This genotypic clustering of CA-MRSA strains vs. HA-MRSA strains has been noted by several investigators (Fey, 2001; Charlebois 2001).

7. SURVEILLANCE

7.1 Passive Surveillance

Invasive MRSA infection (positive culture from a sterile site) is a reportable condition in Louisiana. However MRSA became reportable at a time when infections were not very frequent. Any infection causing signs and symptoms was reportable, Colonization with MRSA was never reportable. With MRSA becoming the predominant *Staphylococcus aureus* strain in hospital and its increasing frequency in community associated staphylococcal infections, passive reporting of all isolates is no longer practical or useful therefore the objective of passive reporting is now **to identify invasive staphylococcal infection to detect any shift in the incidence of virulent invasive MRSA.**

7.1.1 Case Definition of Reportable MRSA

7.1.2 Clinical Case Definition

A disease with signs and symptoms of systemic of focalized infection of internal organ (septicemia, internal abscess …).
NOTE: Superficial infection (boils, abscesses, carbuncles…) isolates from urine, sputum, nasal swabs, wound exudates and any other isolate from colonization are not reportable.

7.1.3 Lab Confirmation

Isolation of a methicillin (oxacillin) resistant Staphylococcus aureus

7.2 Laboratory Based Surveillance (MRSA and other selected antibiotic resistant microorganisms)

7.2.1 Reporting of Aggregate Data by Participating Laboratories

The goals of the Antibiotic Sensitivity Active Surveillance System is to estimate the percent of selected bacteria in the state that are resistant to antibiotics, (MRSA, VRSA, DRSP, and VRE) by the reporting of laboratory aggregate data.

Participating microbiology laboratories should report the total number of *Staphylococcus aureus, Streptococcus pneumoniae*, and enterococcus species isolated in their lab for each month. Among these isolates, the total number of drug resistant or drug intermediate resistant isolates should be reported.

Duplicate isolates on a patient should not be counted.

Aggregate Laboratory Data forms are used for reporting. This form is to be filled out and returned to the Infectious Disease Epidemiology Department by the 20th of the next month. For instance, January data should arrive by the 20th of February. A quarterly and annual report of the cumulative data by public health region and statewide are sent back.

7.2.2 Submission of Isolates by All Laboratories

All cases of Vancomycin Resistant (intermediate or fully resistant) S. aureus (VRSA) are still reportable whatever the site. Culture isolates should be forwarded to the state laboratory.

8. VANCOMYCIN RESISTANT STAPHYLOCOCCUS AUREUS (VRSA)

After MRSA became more prevalent in the 1980s, Vancomycin became increasingly used since it was often the only anitibiotic effective for the treatment of HA-MRSA life threathening infections. Unfortunately, Vancomycin was also overused for example routine surgical prophylaxis, decolonization of patients, and treatment of minor infections. In the late 1990s, Vancomycin Intermediate Resistant S.aureus (VISA) were reported. The source of the resistance seems to be a transfer of resistance genes, particularly VanA from VRE.

Since 1989, a rapid increase in the incidence of infection and colonization with VRE has been reported by U.S. hospitals. This increase poses important problems such as the possibility that the vancomycin-resistant genes present in VRE can be transferred to other gram-positive .microorganisms (e.g., Staphylococcus aureus). Conjugative transfer of the VanA gene has been demonstrated in vitro (Noble 1992).

There is much greater concern about VRSA than there is for VRE. VRSA could become the most prevalent staphylococcus infecting humans. Staphylococci are more virulent and cause more infections than enterococci. It is of utmost importance to prevent the dissemination of VRSA.

8.1 Precautions in Institutions

In general, the precautions are the same as for MRSA. Standard and contact precautions should be applied meticulously for all patients since cases of VRSA are present and may go undiagnosed for a long time. A patient with known VISA/VRSA should be placed in a private room and have dedicated patient-care items. HCWs providing care to such patients should follow contact precautions (i.e., wearing gowns, masks, and gloves and using antibacterial soap for hand washing).

8.2 Prevention of VRSA Depends on Prevention of VRE

The Hospital Infection Control Practices Advisory Committee for preventing and controlling the spread of vancomycin resistance, with a special focus on VRE was issued in 1995 (HICPAC, 1995). Preventing and controlling the spread of vancomycin resistance will require coordinated, concerted efforts from all involved hospital

departments and can be achieved only if each of the following elements is addressed:

- prudent vancomycin use by clinicians,
- education of hospital staff regarding the problem of vancomycin resistance,
- early detection and prompt reporting of vancomycin resistance in enterococci and other gram-positive microorganisms by the hospital microbiology laboratory,
- immediate implementation of appropriate infection-control measures to prevent person-to-person transmission of VRE.

For further recommendations see:
MMWR September 22, 1995 / 44(RR12);1-13: Recommendations for Preventing the Spread of Vancomycin Resistance Recommendations of the Hospital Infection Control Practices Advisory Committee (HICPAC)

8.3 Laboratory Reporting

Whenever resistance is suspected, S. aureus should be tested for resistance to vancomycin using a MIC method. The isolation of S. aureus with confirmed or presumptive vancomycin resistance should be reported immediately to the Office of Public Health and an isolate forwarded to the State Laboratory.

These isolates are of national interest and will be forwarded to the CDC laboratories.

GLOSSARY

BODY SUBSTANCE ISOLATION: An infection control measure used to prevent transmission of infectious organisms form person-to-person. **Body substance isolation is no longer used**. New Isolation guidelines were issued by CDC in 1996 that have rendered this term obsolete.

CARRIER: A person who is colonized with methicillin-resistant Staphylococcus aureus (MRSA). The organism may be present in the nares (nose), sputum, urine, an open wound, in the stool or on the skin without clinical manifestations of disease. A carrier may transmit the organism to another person through direct contact, usually by contact with hands.

COHORT: A group of MRSA positive patients (infected or colonized) who a physically separated, grouped together (as much as is architecturally allowed) during an outbreak and cared for by staff who do not care for MRSA negative patients.

COLONIZATION: Presence of MRSA on tissue without the presence of symptoms or clinical manifestations of illness or infection. A carrier is a person who is colonized with MRSA.

DECOLONIZATIONS: Elimination of MRSA carried by persons through the use of infection control measures and/or antibiotics.

DRSP: Drug Resistant Streptococcus Pneumoniae

ENDEMIC RATE: The usual rate or prevalence of persons infected and/or colonized with MRSA in a facility. The endemic rate in each facility will be unique.

EPIDEMIC: See Outbreak

EPIDEMIOLOGICALLY -LINKED: The finding of a factor or factors that may relate to the spread of MRSA and that are shared by patients with MRSA, e.g., care by a common infected employee, sharing a room.

ERADICATION: Elimination of infections and/or colonization of MRSA in a facility through implementation of infection control and hygiene measures and/or antibiotics.

FOMITE: An inanimate object that may become contaminated by pathogenic organisms, such as MRSA. Examples include stethoscopes, blood pressure cuffs, handkerchiefs, bed linens, and clothing.

GISA: Glycopeptide-Intermediate *S. aureus.* The term glycopeptide refers to a group of antimicrobial agents that includes vancomycin and teicoplanin. Since the first two VISA isolates in the United States were also resistant to teicoplanin, the term glycopeptide-intermediate *S. aureus* (GISA) was used to indicate this broader resistance profile. While GISA may be a more specific term for strains intermediate to both vancomycin and teicoplanin, not all VISA strains are intermediate to teicoplanin; therefore, VISA is a more accurate and more widely used term.

INFECTION: Invasion and multiplication of MRSA in tissue with the manifestation of clinical symptoms of infections such as increased white blood cell count, fever, lesions, boils, drainage from a break in skin continuity, and erythema.

INVASIVE DISEASE: Clinical manifestations of symptoms caused by MRSA such as furuncles, boils, pneumonia, carbuncles, septicemia, or osteomyelitis.

INVASIVE SITE: Any place on an individual's body where the normal skin or mucous membrane barrier is broken, either by natural or artificial means, including decubitus ulcers, surgical incisions, intravenous or urinary catheters, and feeding gastrostomy or jejunostomy sites.

MLST: Multi-Locus Sequence Typing is an unambiguous procedure for characterising isolates of bacterial species using the sequences of internal fragments of seven house-keeping genes. Approx. 450-500 bp internal fragments of each gene are used, as these can be accurately sequenced on both strands using an automated DNA sequencer. For each house-keeping gene, the different sequences present within a bacterial species are assigned as distinct alleles and, for each isolate, the alleles at each of the seven loci define the allelic profile or sequence type (ST).

MRSA (METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS): A gram-positive bacteria that grows in clusters like grapes and is coagulase positive and is resistant to methicillin and other semisynthetic antibiotics (e.g., nafcillin and oxacillin) that are effective against most strains of *S. aureus*.

MSSA (METHICILLIN-SENSITIVE STAPHYLOCOCCUS AUREUS): a STAPHYLOCCOCCUS AUREUS STRAIN THAT IS STILL SENSITIVE TO OXACILLIN AND METHICILLIN.

NOSOCOMIAL INFECTION: An infection associated in a hospital, nursing home, or other health care facility.

OUTBREAK: In hospitals: Three or more cases of epidemiologically linked MRSA infections within 30 days of hospitalization

In nursing homes/extended-care facilities: Three or more cases of epidemiologically linked MRSA infections within a 30 day period, OR any substantial increase in number of cased from the endemic rate even if not epidemiologically linked.

PFGE (Pulse Field Gel Electrophoresis) is a laboratory technique that divides bacterial DNA into fragments. These fragments are embedded into a gel. An electric current is applied to the gel, causing the fragments to move across the gel. This movement leaves a pattern of bands. These bands are compared to determine the relatedness of different organisms. Ideally, the pattern of the bands among the outbreak isolates will be the same while those not related to the outbreak will be different. However, all of the bands from the outbreak organism may not be the same, for various reasons; therefore, the following guidelines are used. Isolates with more than a six band difference are considered unrelated to the outbreak organism. Isolates with a four to six band difference are considered possibly related to the outbreak organism and those with two or three band difference are usually considered subtypes of the outbreak organism.

SA (*Staphylococcus Aureus*): A gram-positive bacteria which grows in clusters like grapes and is coagulase positive; SA may be sensitive to methicillin, cephalosporins, nafcillin, and oxacillin, in which case it is referred to as MSSA (methicillin-sensitive *Staphylococcus aureus*).

SURVEILLANCE: Monitoring of patient data at regular intervals to determine the number and characteristics of new infections and distribution within a facility.

SUSCEPTIBILITY TESTING: The laboratory tests used to determine if an organism could be effectively treated with particular antibiotics. Patterns of antibiotic susceptibility of MRSA isolates can be used to indicate epidemiologic linkage and identify outbreaks. The only antibiotic susceptibility tests that are of importance in determining antibiotic therapy for MRSA infections are penicillin, oxacillin, vancomycin and TMP-SMX.

TRANSMISSION: The passage of MRSA from a colonized or infected individual to a person previously free of the organism.

VRSA (VANCOMYCIN-RESISTANT STAPHYLOCOCCUS AUREUS): A gram-positive bacteria that grows in clusters like grapes and is coagulase positive and is resistant to vancomycin.

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